

**Independent Review of the Scientific Management Recommendations
in the
June 1998 Large Coastal Shark Evaluation Workshop Report**

Reviewer No. 4¹

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Natural Resources Consultants, Inc.

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¹ Reviewers' statements are provided in their original and unaltered form. The name of the reviewer is available upon written request to NRC with the approval of the court.

UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF FLORIDA
TAMPA DIVISION

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June 1998 Large Coastal Shark Evaluation Workshop Report

Statement: I have reviewed the June 1998 Large Coastal Shark Evaluation Workshop (SEW) Report and the 50 other documents submitted by the Court for review and have come to the following conclusions regarding the scientific management recommendations contain in the 1998 SEW Report.

Court Directed Question:

Response in respect to the Court requirement that, "Each reviewer must make one overall statement as to whether the scientific conclusions and scientific management recommendations contained in the 1998 SEW Report are based on scientifically reasonable uses of the appropriate fisheries stock assessment techniques and the best available (at the time of the 1998 SEW Report) biological and fishery information relating to large coastal sharks."

Response:

The National Marine Fisheries Service convened the 1998 Shark Evaluation Workshop (SEW) to solicit input for assessment and management of shark fishery populations (primarily large coastal sharks). Previous SEWs had identified a serious rate of decline in stock size, and the stated goal of the 1998 SEW effort was to scientifically evaluate the status of the shark fishery. It is the opinion of this reviewer that the scientific conclusions and management recommendations of the 1998 SEW are reasonable based upon the information available at that time.

Response in respect to the Court requirement that, "In reaching this conclusion, reviewers are expected to determine (1) whether the model used to estimate large coastal shark population abundance and demographic trends is reliable and scientifically rigorous and (2) whether the

scientific conclusions and scientific management recommendations are based on a logical extension of the model's results."

Question 1. *Was the model used to estimate large coastal shark population abundance and demographic trends reliable and scientifically rigorous?*

Response:

The report uses a number of different fishery data sets to estimate the relative abundance of stocks over time. The regression analyses for demographic trends based upon catch rate data appear rigorous (summarized in Table 6, 1998 SEW Report) but show no unified evidence to this reviewer that catch rates were improving in the fishery as a whole (despite the use of excessively liberal probability levels of 0.1). A statistical caveat of this analysis is the high variability between years (due to experimental error and other sources) that may mask a true decline or recovery. However, these data sets represent a direct observation on the fishery, and provide the best evidence that the large coastal shark stocks (and individual species) were not recovering across the fishery.

The report used demographic analysis to estimate innate capacity of a population to increase (r). The value of r (and maximum F) = 12%-14% for the sandbar and blacktip sharks appears to be a reasonable estimate for the demographic model. This indicates an upper limit to the sustainable fishery level, and a guide that future F will need to be much lower to allow substantial stock recovery. These data were also used to generate parameters for the stock production projections.

The Bayesian analysis method makes many assumptions about the dynamics of the shark populations and integrates prior population parameter estimates to construct a stock assessment model. However, it appears to be a useful and scientifically rigorous method for viewing the likelihood of future population growth or declines. It seems especially applicable to the shark populations in question since stocks have been so heavily fished over the last 20 years and species-specific data sets are limited. The recovery projections for the blacktip and sandbar populations in the 1998 SEW (and SB-IV-26, SB-IV-27) from the Bayesian analysis are very alarming but consistent with the K-selected life history (long-lived, low reproductive potential, slow maturation) of large coastal shark species.

Question 2 *Were the scientific conclusions and scientific management recommendations based on a logical extension of the model's results?*

Response:

The scientific conclusions appear to be consistent with the analyses. The management recommendations for decreased harvest could be more indirect. Commercial fishery catch rate data did not indicate a significant recovery in stock numbers under the current management plan, although an increase is not necessarily expected at this early time since the implementation of the management quotas. Of particular concern to

this reviewer is the proposal that large coastals "still might require additional reductions in effective fishing mortality rate in order to ensure increases of this resource toward MSY" (1998 SEW, p. 29). This recommendation is equivocal, and does not specifically address how to increase the already heavily fished stocks.

The Bayesian analyses provide useful indicators of how long a recovery plan may take under various catch quota scenarios. The Bayesian models indicate that with a closure of the fishery, the sandbar population would take approximately 10 years and the blacktip fishery 10-20 years to reach MSY. These models, although probabilistic in nature, indicate that a closure of this fishery for recovery purposes is the best way to return these stocks to MSY within a reasonable time period. The 1998 SEW report should have made such a recommendation, since MSY is a significant objective of fishery management science. By not doing this, the population stocks become more susceptible to future ecosystem uncertainties (e.g. natural and man-made factors) that may further negatively impact these populations. These recovery estimates generated by the Bayesian models should be used as a guideline for stock management, and updated as more data become available.

Responses to Directive: In addition, in reviewing the stock assessment, each reviewer may consider, consistent with his/her expertise, among other relevant considerations:

Question 1. how the stock assessment applied the Bayesian modeling approach to the available data and determined the appropriateness of using a non-age specific production model to assess a long-lived species (or species complex)?

Response:

Question 2 how the stock assessment considered the availability and quality (i.e. how the series were estimated, how they were weighted for the analyses, and how they were applied as age specific indices of abundance, particularly for the MRFSS data which accounts for most of the LCS mortality in the early years, other than foreign fishing) of alternative data sets and statistical modeling approaches, including modeling approaches employed in prior shark evaluation workshops)?

Response:

Question 3 how the stock assessment handled and applied information relating to whether the species of LCS under consideration represent open or closed populations in each individual instance?

Response:

Question 4 how the stock assessment evaluated the reliability of projections based on the above three considerations?

Response:

Question 5 how the stock assessment evaluated the effects of extant regulations on stock trajectories, and weighted the risk of maintaining the status quo until these effects could be evaluated against the costs of an additional immediate reduction in permitted LCS landing levels?

Response:

A variety of analyses indicate that maintaining the 1995 status quo catch rate may further negatively impact these already over-fished resources. The high variability in catch effort data makes it unlikely that further stock declines or increases across the fishery as a whole could be detected over a reasonable time period. Thus, it was reasonable to suggest further reductions (or closure) rather than risk further declines in population numbers in the fishery.

RECOMMENDATIONS

1. National Marine Fisheries Service should abandon regulation by large coastal aggregates, and regulate the shark fishery on a species-by-species basis. It should supplement fishery-dependent data with studies on the basic biology, ecology and behavior of each species. Of particular importance is the need to increase information on the short and long-term movement patterns and genetic similarity of regional species stocks.
2. The management of these marine predators should integrate collateral effects upon coastal marine ecosystems and other fisheries. Likewise, the impact of other fisheries (e.g. harvesting of natural prey and the effect of by-catch) upon these populations should be assessed. These animals should be managed conservatively because of their K life history characteristics and critical position in marine food webs.
3. The sport fishery appears to have a very significant impact on the shark populations and should be more heavily regulated to assist in recovery of stocks to MSY.